

POSITIVE SOLUTIONS FOR CONTINUOUS AND DISCRETE BOUNDARY VALUE PROBLEMS TO THE ONE-DIMENSION p -LAPLACIAN

DAQING JIANG, JIFENG CHU, DONAL O'REGAN AND R. P. AGARWAL

Abstract. New existence results (for positive solutions) for continuous and discrete boundary value problems to the one-dimension p -Laplacian are presented in this paper. Here we use a well-known fixed point theorem in cones. Our results improve several recent results established in the literature.

Mathematics subject classification (2000): 34B15, 39A10.

Key words and phrases: positive solutions, continuous and discrete boundary value problem, p -Laplacian, fixed point theorem in cones.

REFERENCES

- [1] R. P. AGARWAL AND D. O'REGAN, *Nonpositive discrete boundary value problems*, *Nonlinear Analysis*, **39** (2000), 207–215.
- [2] R. P. AGARWAL AND D. O'REGAN, *Boundary value problems for discrete equations*, *Appl. Math. Letters*, **10** (1997), 83–89.
- [3] R. P. AGARWAL, D. O'REGAN AND P. J. Y. WONG, *Positive solutions of differential, difference and integral equations*, Kluwer Acad. Publ, Dordrecht, (1999).
- [4] R. P. AGARWAL AND D. O'REGAN, *Singular discrete boundary value problems*, *Appl. Math. Letters*, **12** (1999), 127–131.
- [5] R. P. AGARWAL, H. LU AND D. O'REGAN, *Eigenvalues and the one-dimensional p -Laplacian*, *Journal of Mathematics Analysis and Applications*, **266** (2002), 383–400.
- [6] A. BEN-NAOUM AND C. DE COSTER, *On the existence and multiplicity of positive solutions of the p -Laplacian separated boundary value problems*, *Differential and Integral Equations*, **10** (1997), 1093–1112.
- [7] D. DUNNINGER AND H. WANG, *Multiplicity of positive radial solutions for an elliptic system on an annulus*, *Nonlinear Analysis*, **42** (2000), 803–811.
- [8] D. DUNNINGER AND H. WANG, *Existence and multiplicity of positive radial solutions for elliptic systems*, *Nonlinear Analysis*, **29** (1997), 1051–1060.
- [9] C. DE COSTER, *Pairs of positive solutions for the one-dimensional p -Laplacian*, *Nonlinear Analysis*, **23** (1994), 669–681.
- [10] K. DEIMLING, *Nonlinear Functional Analysis*, Springer, Berlin, (1985).
- [11] L. ERBE, S. HU AND H. WANG, *Multiple positive solutions of some boundary value problems*, *Journal of Mathematics Analysis and Applications*, **184** (1994), 743–748.
- [12] L. KONG AND J. WANG, *Multiple positive solutions for the one-dimensional p -Laplacian*, *Nonlinear Anal.* **42** (2000), 1327–1333.
- [13] D. O'REGAN, *Some general existence principles and results for $[\phi(y)']' = q(t)f(t, y, y')$, $(0 < t < 1)$* , *SIAM J. Math. Anal.* **24** (1993), 648–668.
- [14] D. O'REGAN, *Existence Theory for Nonlinear Ordinary Differential Equations*, Kluwer Academic, Dordrecht, 1997.
- [15] H. WANG, *On the existence, multiplicity and nonexistence of positive solutions of boundary value problems involving the p -Laplacian*, submitted.

- [16] J. Y. WANG, *The existence of positive solutions for the one-dimensional p -Laplacian*, Proc. Amer. Math. Soc. **125** (1997), 2275–2283.
- [17] J. WANG, W. GAO AND Z. LIN, *Boundary value problems for general second order equations and similarity solutions to the Rayleigh problem*, Tohoku Math. J. **47** (1995), 327–344.
- [18] H. WANG, *On the existence of positive solutions for semilinear elliptic equations in the annulus*, J. Differential Equations, **109** (1994), 1–7.
- [19] D. Q. JIANG AND W. GAO, *Upper and lower solution method and a singular boundary value problem for the one-dimension p -Laplacian*, J. Math. Anal. Appl. **252** (2000), 631–648.
- [20] D. Q. JIANG, *Upper and lower solutions method and a superlinear singular boundary value problem for the one-dimension p -Laplacian*, Computers and Mathematics with Applications, **42** (2001), 927–940.
- [21] D. Q. JIANG AND H. LIU, *On the existence of nonnegative radial solutions for P -Laplacian elliptic systems*, Ann. Polon. Math. **LXXI.1** (1999), 19–29.
- [22] D. Q. JIANG, P. Y. PANG AND R. P. AGARWAL, *Upper and lower solutions method and a superlinear singular discrete boundary value problem*, Dynamics Systems and Applications, to appear.
- [23] D. Q. JIANG, L. ZHANG, D. O’REGAN AND R. P. AGARWAL, *Existence theory for single and multiple solutions to singular positive discrete Dirichlet boundary value problems to the one-dimension p -Laplacian*, **13** (2003), 179–199.
- [24] KUNQUAN LAN AND JEFFREY R. L. WEBB, *Positive solutions of semilinear differential equations with singularities*, J. Differential Equations, **148** (1998), 407–421.